2009 Conant Prize

JOHN W. MORGAN received the 2009 AMS Levi L. Conant Prize at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009.

Citation

The Levi L. Conant Prize for 2009 is awarded to John Morgan for his article, "Recent progress on the Poincaré Conjecture and the classification of 3-manifolds", *Bull. Amer. Math. Soc.* **42** (2005), 57–78.

John W. Morgan

The celebrated Poincaré Conjecture, formulated in modern terms, asks, "Is a closed 3-manifold having trivial fundamental group diffeomorphic to the 3-dimensional sphere?" This conjecture evolved from Poincaré's 1904 paper and inspired an enormous amount of work in 3-dimensional topology in the ensuing century. Thurston's Geometrization Conjecture subsumes the Poincaré Conjecture as a special case and speculates which 3-manifolds admit a Riemannian metric of constant negative curvature 1.

By proposing the existence of nice metrics on 3-manifolds, Thurston's far-reaching conjecture links together in an essential way the relevant topology and geometry and suggests a more analytic approach to classifying 3-manifolds. Hamilton's remarkable series of papers develops one such geometric-analytic approach using the Ricci flow and establishes crucial analytic estimates for evolving metrics and curvature. This set the stage for Perelman's much acclaimed work and the ultimate proof of these conjectures.

Morgan's paper was written in 2004 at a critical juncture in this story, just after the appearance of Perelman's papers and while they were still undergoing scrutiny by experts. It made the momentous developments surrounding the conjectures of Poincaré and Thurston accessible to a wide mathematical audience. The article captured key concepts and results from topology and differential geometry and conveyed to the reader the significance of the advances.

Morgan's exposition is elegant and mathematically precise. The paper transmits a great amount of information in a seemingly effortless flow of mathematical ideas from across a broad spectrum of topics. It was a valuable survey when it appeared and remains so today.

Biographical Sketch

Morgan received his Ph.D. in mathematics from Rice University in 1969. From 1969 to 1972 he was an instructor at Princeton University, and from 1972 to 1974 an assistant professor at the Massachusetts Institute of Technology. From 1974 to 1976 he was member of Institut des Hautes Etudes Scientifiques in Paris. Since becoming a professor of mathematics at Columbia University in 1976, he has also been a visiting professor at Stanford, Harvard, the Institute for Advanced Study, the Mathematical Sciences Research Institute in Berkeley, Université Paris-Sud, and IHES. He will become the founding director of the Simons Center for Geometry and Physics in Stony Brook in September 2009.

Morgan's mathematical speciality is topology and geometry, and he has worked on high-dimensional surgery, the topology of Kähler manifolds, and the topology and geometry of manifolds of dimensions 3 and 4. He is an editor of the *Journal of the American Mathematical Society*.

Morgan lives in New York City with his wife. They have two children—Jake, who lives in London, and Brianna, who is an undergraduate at Columbia University.

Response

I am honored to be awarded the 2009 Levi L. Conant Prize for my article, "Recent Progress on the Poincaré Conjecture and the Classification of 3-manifolds".

This is one of the most amazing developments in mathematics, representing as it does the solution of a 100-year-old problem. The advance is even more interesting because it uses a beautiful combination of analytic and geometric tools to solve a topological problem. It was a great pleasure to decipher these arguments and to understand their beauty and power—and the pleasure was only increased in the telling of the story. In working through the arguments behind these results, I benefited from the insights of various people, and it is a pleasure to thank them. First and foremost is Gang Tian with whom I have had a collaboration spanning several years as we sorted out in great detail the arguments. I had many fruitful discussions with Bruce Kleiner, John Lott, and Tom Mrowka. Finally, my greatest gratitude goes to Richard Hamilton, who developed the theory of Ricci flow and suggested the program to use this method to solve the 3-dimensional problems, and above all to Grigory Perelman whose mathematical power and insight led to the resolution of the conjectures.

About the Prize

The Conant Prize is awarded annually to recognize an outstanding expository paper published in either the *Notices of the AMS* or the *Bulletin of the AMS* in the preceding five years. Established in 2000, the prize honors the memory of Levi L. Conant (1857–1916), who was a mathematician at Worcester Polytechnic University. The prize carries a cash award of US$1,000.

The Conant Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prize, the members of the selection committee were: Georgia Benkart, Stephen J. Greenfield, and Carl R. Riehm (chair).

Previous recipients of the Conant Prize are: Carl Pomerance (2001); Elliott Lieb and Jakob Yngvason (2002); Nicholas Katz and Peter Sarnak (2003); Noam D. Elkies (2004); Allen Knutson and Terence Tao (2005); Ronald M. Solomon (2006); Jeffrey Weeks (2007); and J. Brian Conrey, Shlomo Hoory, Nathan Linial, and Avi Wigderson (2008).